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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/803,712	03/18/2004	Yee-Chia Yeo	TSM03-0760	7832

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EXAMINER	
RAYMOND, BRITTANY L	
ART UNIT	PAPER NUMBER
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/803,712	YEO ET AL.	
	Examiner	Art Unit	
	BRITTANY RAYMOND	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 January 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38,40-49,52-55,58-60,62-68,70,71 and 73-75* is/are pending in the application.

4a) Of the above claim(s) *1-37* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *38,40-49,52-55,58-60,62-68,70,71 and 73-75* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/31/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Claims 1-37 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 4/10/2007.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 52 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 52 recites the limitation "the fluorine containing compound" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 38, 40-49 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda (U.S. Patent 5715039) in view of French (U.S. Patent Publication 2004/0175647) and Fisher (U.S. Patent Publication 2004/0209411).

Fukuda discloses an immersion lithography method and apparatus comprising: placing a wafer onto a wafer support, placing a chemically amplified photoresist onto the wafer, supplying an immersion fluid of water between an optical surface and the wafer support so that the immersion fluid contacts the photoresist, and projecting a patterned beam having radiation of 193 nm onto the photoresist layer (Column 1, Lines 63-66, Column 10, lines 1-12 and Figure 15b), as recited in claims 38 and 59 of the present invention. It is inherent that water has a pH of about 7, which means that it could be 6.999, making the pH less than 7, as recited in claims 38 and 40-43 of the present invention. Also, it is known by one of ordinary skill in this art that pH is equal to –log [H+], as shown by Brown (Chemistry: The Central Science). Thus, claims 44-47 are equal to claims 40-43, respectively, and are rejected for the same reasons. Fukuda also teaches that after exposure, the photoresist is commonly developed (Column 15, Lines 45-47), as recited in claim 38 of the present invention.

Fukuda fails to disclose that the optical surface can be silicon oxide or calcium fluoride, and that the photoresist is coated over an integrated circuit that includes transistors with a gate length not greater than 50 nm.

French ('647) discloses that a compound lens can be made out of calcium fluoride or hydroxyl free silica, also known as silicon dioxide, when used in an immersion lithography process (Paragraphs 0190 and 0191), as recited in claims 48 and 49 of the present invention. It is known by one of ordinary skill in this art that silicon dioxide and silicon oxide have similar properties. Also, it is inherent that these types of lenses are soluble in water, as recited in claim 38 of the present invention.

Fisher discloses a process of manufacturing an integrated circuit device comprising: coating a substrate with a layer of photoresist, exposing and developing the photoresist to form a gate pattern, and trimming the gate pattern to form a gate of a transistor with a critical dimension of less than 60 nm (Paragraph 0012), as recited in claim 38 of the present invention. Although Fisher only discusses the process of forming a transistor in an integrated circuit, it would be known by one of ordinary skill in the art that the circuit is much more intricate and would involve placing other photoresists on the substrate to form the other features of the circuit, as recited in claim 38 of the present invention.

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have used silicon oxide or calcium fluoride for the optical surface, as suggested by French ('647), in the process of Fukuda because French ('647) teaches that this type of material works well with the type of exposure light used in the present invention. It also would have been obvious to one of ordinary skill in the art to have performed the immersion photolithography process of Fukuda over transistors of reduced sizes, as suggested by Fisher, because Fisher teaches that

photolithography processes are commonly used to build up integrated circuits and transistors with reduced widths are desired, which immersion lithography produces.

6. Claims 52-55, 63-68, 70, 71 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda (U.S. Patent 5715039) in view of French (U.S. Patent Publication 2004/0175647) and Fisher (U.S. Patent Publication 2004/0209411) as applied to claims 38, 40-49 and 59 above, and further in view of Kunz (U.S. Patent Publication 2005/0164522).

The teachings of Fukuda, French ('647) and Fisher have been discussed in paragraph 5 above. Fukuda, French ('647) and Fisher teach every limitation of dependent claims 64-68 and 74 of the present invention.

Fukuda, French ('647) and Fisher fail to disclose that a fluorine containing compound is dissolved in water, that the fluorine containing compound can be sodium fluoride, potassium fluoride or hydrogen fluoride, and that the concentration of the fluoride ions is greater than 0.01, 0.05, and 0.1 mol/L.

Kunz discloses a composition for an immersion lithography liquid comprising sodium fluoride (Paragraph 0135) as recited in claims 52, 63 and 70 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used sodium fluoride, as suggested by Kunz, in the immersion fluid in the processes of Fukuda, French ('647) and Fisher because Kunz teaches that using this compound allows for a more accurate exposure step of the immersion lithography process. It also would have been obvious to one of ordinary skill

in the art to have used the range of concentrations of fluoride ions recited in claims 53-55 and 71 because this concentration determines the pH of the immersion fluid and can be determined by one of ordinary skill in the art without undue experimentation to form the fairly neutral to slightly acidic pH levels recited in claims 40-43 of the present invention.

7. Claims 38, 40-49 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rostalski (U.S. Patent Publication 2003/0174408) in view of Casiday ("Water Hardness: Inorganic Reactions Experiment"), French (U.S. Patent Publication 2004/0175647) and Fisher (U.S. Patent Publication 2004/0209411).

Rostalski discloses an immersion lithography method comprising: placing a photoresist layer onto a substrate, which is placed on a wafer support, filling a space between the wafer and an optical surface with a deionized water immersion fluid so that it contacts the photoresist layer, and projecting a patterned beam through the system to the substrate (Paragraphs 0042, 0051-0052), as recited in claims 38 and 59 of the present invention.

Rostalski fails to disclose that the immersion fluid has a pH less than 7 and in the range of 2 to 7, 4 to 7, 5 to 7, and 6 to 7, that the resist is developed after exposure, that the photoresist comprises a chemically amplified resist, and that the optical surface can be silicon oxide or calcium fluoride.

Casiday discloses that the pH of deionized water is typically found to be around 6 (Page 4, number 3), as recited in claims 38 and 40-43 of the present invention. Also, it is known by one of ordinary skill in this art that pH is equal to –log [H+], as shown by

Brown (Chemistry: The Central Science). Thus, claims 44-47 are equal to claims 40-43, respectively, and are rejected for the same reasons.

French ('647) discloses that a compound lens can be made out of calcium fluoride or hydroxyl free silica, also known as silicon dioxide, when used in an immersion lithography process (Paragraphs 0190 and 0191), as recited in claims 48 and 49 of the present invention. It is known by one of ordinary skill in this art that silicon dioxide and silicon oxide have similar properties. Also, it is inherent that these types of lenses are soluble in water, as recited in claim 38 of the present invention.

Fisher discloses a process of manufacturing an integrated circuit device comprising: coating a substrate with a layer of photoresist, exposing and developing the photoresist to form a gate pattern, and trimming the gate pattern to form a gate of a transistor with a critical dimension of less than 60 nm (Paragraph 0012), as recited in claim 38 of the present invention. Although Fisher only discusses the process of forming a transistor in an integrated circuit, it would be known by one of ordinary skill in the art that the circuit is much more intricate and would involve placing other photoresists on the substrate to form the other features of the circuit, as recited in claim 38 of the present invention. Fisher also discloses that the photoresist used in the process can be a chemically amplified resist (Paragraph 0027), as recited in claim 38 of the present invention.

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have used deionized water with a pH less than 7, as suggested by Casiday, as the immersion fluid of Rostalski because Casiday teaches

that deionized water often has pH levels in the acidic region. It also would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have used silicon oxide or calcium fluoride for the optical surface, as suggested by French ('647), in the process of Rostalski because French ('647) teaches that this type of material works well with the type of exposure light used in the present invention. It would have been obvious to one of ordinary skill in the art to have performed the immersion photolithography process of Fukuda over transistors of reduced sizes, as suggested by Fisher, because Fisher teaches that photolithography processes are commonly used to build up integrated circuits and transistors with reduced widths are desired, which immersion lithography produces. Finally, it would have been obvious to one of ordinary skill in the art to have used a chemically amplified resist and developed the resist after exposure, as suggested by Fisher, because Fisher teaches that these are common steps in the process of manufacturing integrated circuit devices using photoresists.

8. Claims 52-55, 63-68, 70, 71 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rostalski (U.S. Patent Publication 2003/0174408) in view of Casiday ("Water Hardness: Inorganic Reactions Experiment"), French (U.S. Patent Publication 2004/0175647) and Fisher (U.S. Patent Publication 2004/0209411) as applied to claims 38, 40-49 and 59 above, and further in view of Kunz (U.S. Patent Publication 2005/0164522).

The teachings of Rostalski, Casiday, French ('647) and Fisher have been discussed in paragraph 7 above. Rostalski, Casiday, French ('647) and Fisher teach every limitation of dependent claims 64-68 and 74 of the present invention.

Rostalski, Casiday, French ('647) and Fisher fail to disclose that a fluorine containing compound is dissolved in water, that the fluorine containing compound can be sodium fluoride, potassium fluoride or hydrogen fluoride, and that the concentration of the fluoride ions is greater than 0.01, 0.05, and 0.1 mol/L.

Kunz discloses a composition for an immersion lithography liquid comprising sodium fluoride (Paragraph 0135) as recited in claims 52, 63 and 70 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used sodium fluoride, as suggested by Kunz, in the immersion fluid in the processes of Rostalski, Casiday, French ('647) and Fisher because Kunz teaches that using this compound allows for a more accurate exposure step of the immersion lithography process. It also would have been obvious to one of ordinary skill in the art to have used the range of concentrations of fluoride ions recited in claims 53-55 and 71 because this concentration determines the pH of the immersion fluid and can be determined by one of ordinary skill in the art without undue experimentation to form the fairly neutral to slightly acidic pH levels recited in claims 40-43 of the present invention.

9. Claim 62 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rostalski (U.S. Patent Publication 2003/0174408) in view of Casiday ("Water Hardness:

Inorganic Reactions Experiment"), French (U.S. Patent Publication 2004/0175647) and Fisher (U.S. Patent Publication 2004/0209411) as applied to claims 38, 40-49 and 59 above, and further in view of French (U.S. Patent Publication 2004/0038556).

The teachings of Rostalski, Casiday, French ('647) and Fisher have been discussed in paragraph 7 above.

Rostalski, Casiday, French ('647) and Fisher fail to disclose that the step of developing the photoresist layer comprises immersing the photoresist in a tetramethylammonia hydroxide solution.

French ('556) discloses a photolithography process comprising: exposing a photoresist to light through an immersion oil, and developing the photoresist to form a pattern in the photoresist (Paragraph 0114), as recited in claims 38 and 63 of the present invention. French ('556) also discloses that development is performed using tetramethylammonium hydroxide (Paragraph 0158), as recited in claim 62 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have developed the resist with tetramethylammonium hydroxide, as suggested by French ('556) in the process of Rostalski, Casiday, French ('647) and Fisher because French ('556) teaches that this is a common step in immersion lithography that forms accurate patterns in the photoresist layer.

10. Claims 58, 60, 73 and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rostalski (U.S. Patent Publication 2003/0174408), Casiday ("Water Hardness: Inorganic Reactions Experiment"), French (U.S. Patent Publication

2004/0175647), Fisher (U.S. Patent Publication 2004/0209411) and Kunz (U.S. Patent Publication 2005/0164522) as applied to claims 38, 40-49, 52-55, 59, 62-68, 70, 71 and 74 above, and further in view of Levinson (U.S. Patent Publication 2005/0018208).

The teachings of Rostalski, Casiday, French ('647), Fisher and Kunz have been discussed in paragraphs 7 and 8 above.

Rostalski, Casiday, French ('647), Fisher and Kunz fail to disclose that the stage and the semiconductor are immersed in the immersion fluid.

Levinson discloses an immersion lithography apparatus comprising a stage upon which the wafer to be patterned is mounted (Paragraph 0018). Levinson shows in Figure 1 that the wafer region is immersed in the immersion fluid, as recited in claims 58 and 73 of the present invention. It would be obvious to immerse the stage underlying the wafer in the immersion fluid since the stage is part of the wafer region, as recited in claims 60 and 75 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have immersed the stage and the semiconductor in the immersion fluid, as suggested by Levinson, in the process of Rostalski, Casiday, French ('647), Fisher and Kunz because Levinson teaches that immersing the whole stage and substrate allows for the pattern to be formed properly.

Response to Arguments

11. Applicant's arguments, filed 1/20/2009, have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, due to the

amendments made to the claims, a new ground(s) of rejection is made in view of a newly found prior art reference.

Regarding claims 38, Applicant argues that Fukuda does not suggest of disclose the material used for the photoresist, the pH used in the immersion liquid and the composition of the water. Fukuda discloses that chemically amplified resist can be used in the process. Fukuda also discloses that water is used as the immersion liquid. It would be well known by one of ordinary skill in the art that the pH of water is about 7, as recited in dependent claims 40-43. This would mean that the pH could be 6.999, which is less than 7. Also, claims 44-47 recite that the hydrogen ions can have a concentration of 10^{-7}, which would be known by one of ordinary skill in the art to be equal to a pH of 7. Claim 38 only recites that the immersion fluid is water and does not describe anything else about the composition of the liquid.

Applicant also argues that the combination of Rostalski, Casiday and French ('556) do not teach that the water comprises fluoride. Claim 38 of the present invention does not recite that fluoride is present in the immersion fluid. Therefore, Rostalski, Casiday and French ('556) are not required to teach this. As to claim 63, the reference, Kunz, has been combined with the cited art in order to teach that a fluoride can be added to an immersion fluid.

Regarding claims 48, 49, 67 and 68, Applicant argues that French '647 cannot be combined with the cited art of the independent claims because it teaches that compounds free from water are desirable as immersion liquids, which is in direct contrast to the immersion liquids claimed. French '647 teaches common materials used

for the optical surface in an immersion lithography process. It would be known by one of ordinary skill in the art that several types of immersion fluids can be used in an immersion lithography process, such as water or an oil. Therefore, since Fukuda or Rostalski and French '647 teach an immersion lithography process, it would be obvious to be able to use the lenses of French '647 in the fluid of Fukuda or Rostalski.

As to the rejections using Kunz, Applicant argues that Kunz does not teach that the immersion fluid is one in which the resist could be affected. The claims of the present invention do not require that the immersion fluid is chosen so that it affects the photoresist. Applicant also argues that Kunz cannot be combined with the cited art because it teaches non-water based immersion fluids, which is in direct contrast to the immersion liquids claimed. It would be known by one of ordinary skill in the art that several types of immersion fluids can be used in an immersion lithography process, such as water or a non-water based fluid. Therefore, it would be obvious to one of ordinary skill in the art that the fluoride of Kunz could be added to a water based immersion fluid because it creates fine photoresist patterns just as a non-water based immersion fluid would.

Regarding the remaining dependent claims, the cited art teaches every limitation of these claims.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRITTANY RAYMOND whose telephone number is (571)272-6545. The examiner can normally be reached on Monday through Friday, 8:30 a.m. - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kathleen Duda/
Primary Examiner, Art Unit 1795

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